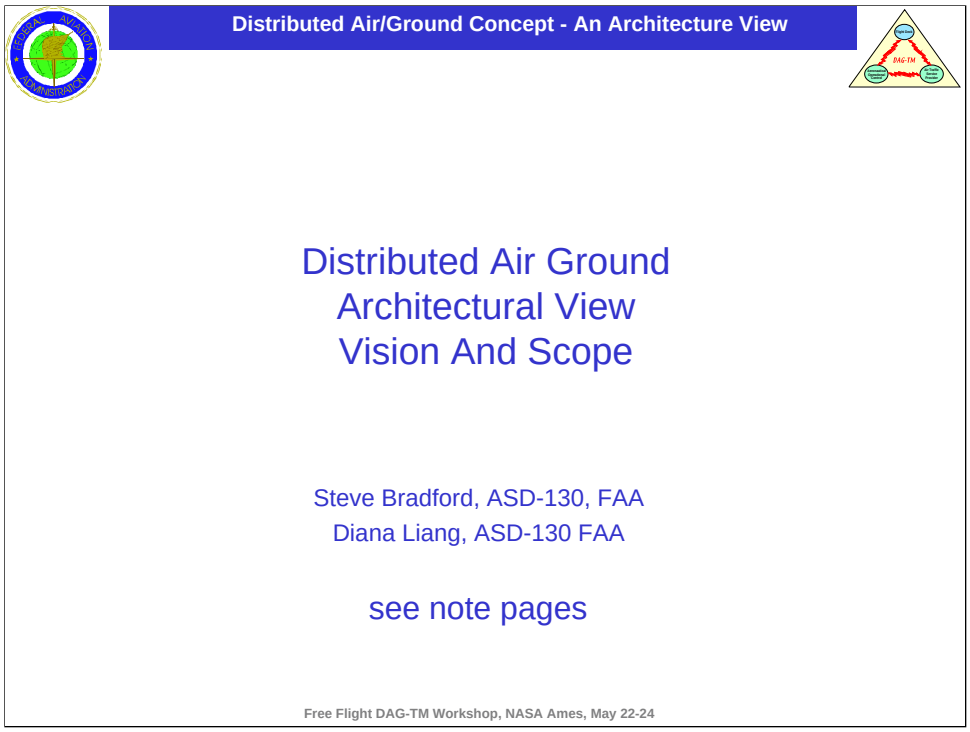
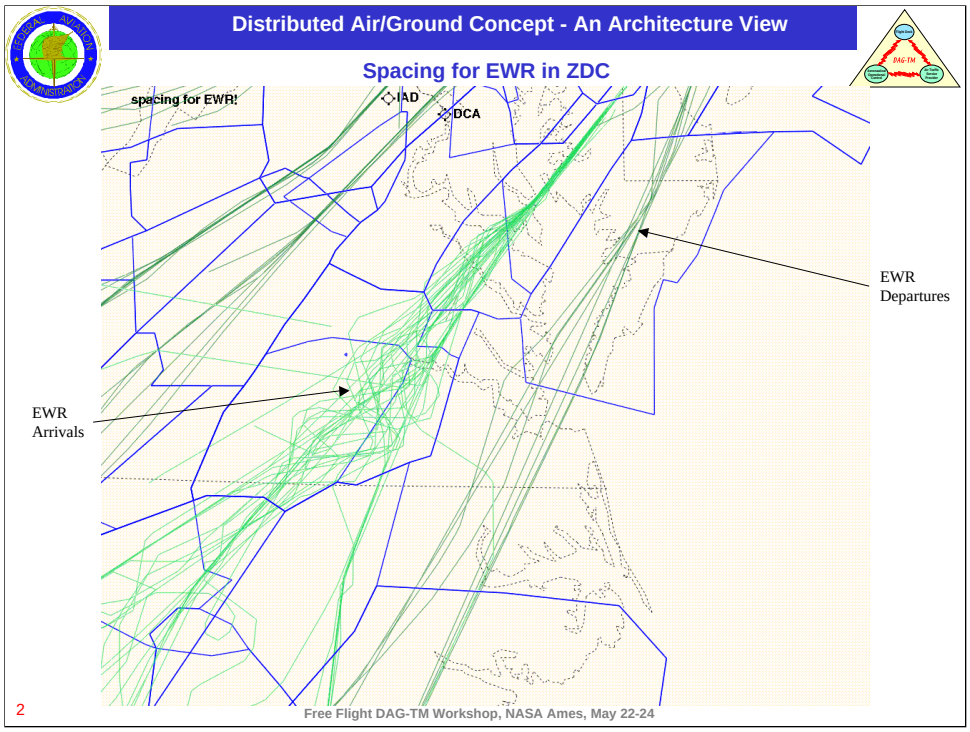



We appreciate the opportunity to take look at the DAG concept from an architecture viewpoint. We will examine the words of the concept and highlight those which have architectural implications.

We will then examine those briefly with respect to how will DAG fit into the NAS? What is the environment in which it must fit, how will it offer both improved flight performance and flow performance?

We note that the NAS is a complex place.

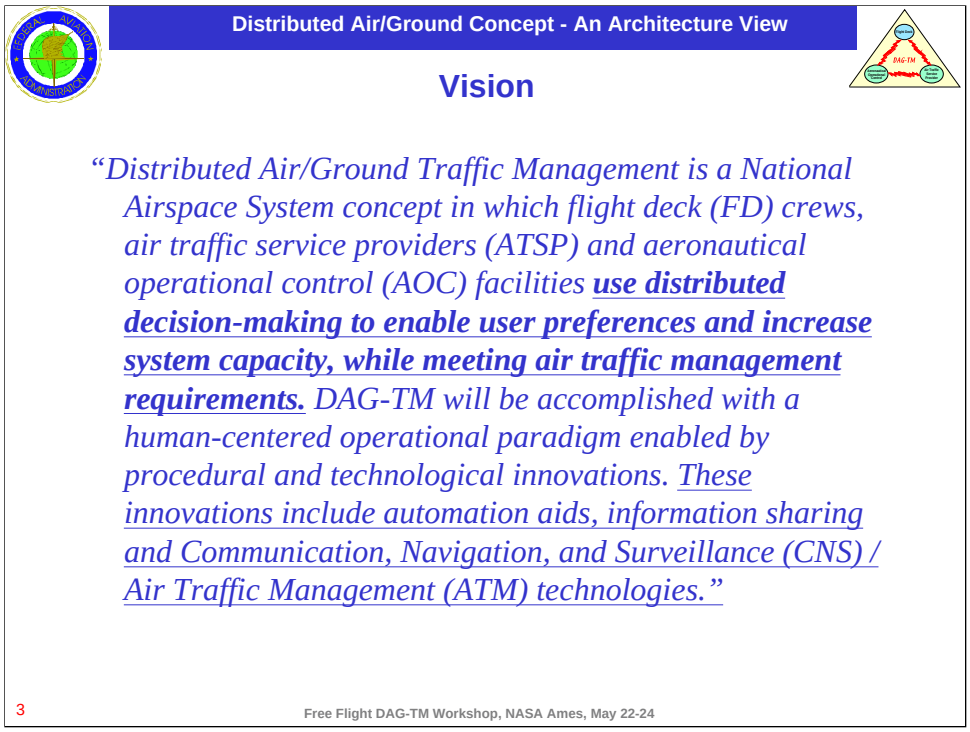



An example of this complexity. We are looking at arrivals into Newark Airport. The arrow tip is pointing at S-curves in the vicinity of Richmond, Virginia a distance of over 400 miles south of Newark New Jersey. At first glance these curves represent individual inefficiencies since it is obvious that the flights are not achieving their individual nominal flight plans. From a flow point of view, these curves represent a procedural multi-center metering for the transition to arrival of aircraft to Newark. The efficacy/inefficacy of that process might be measured if we aggregate the flow across the meter fixes and identify whether the flow rate matches the acceptance rate of the airport's arrival state.

This one potential measure of efficiency, but efficiency can only really be measured with respect to stated objective. If the goal is maximum throughput, this may be the right implementation, or perhaps a version of a Traffic Management Advisor will help. If the goal is minimum fuel, the assignment of slots for departure to allow for minimum vectoring to the arrival fix might be contemplated.

Notice also that the transition to arrival for Newark begins well south of Washington (DCA and IAD) which means that departure are going directly from departure to collection.

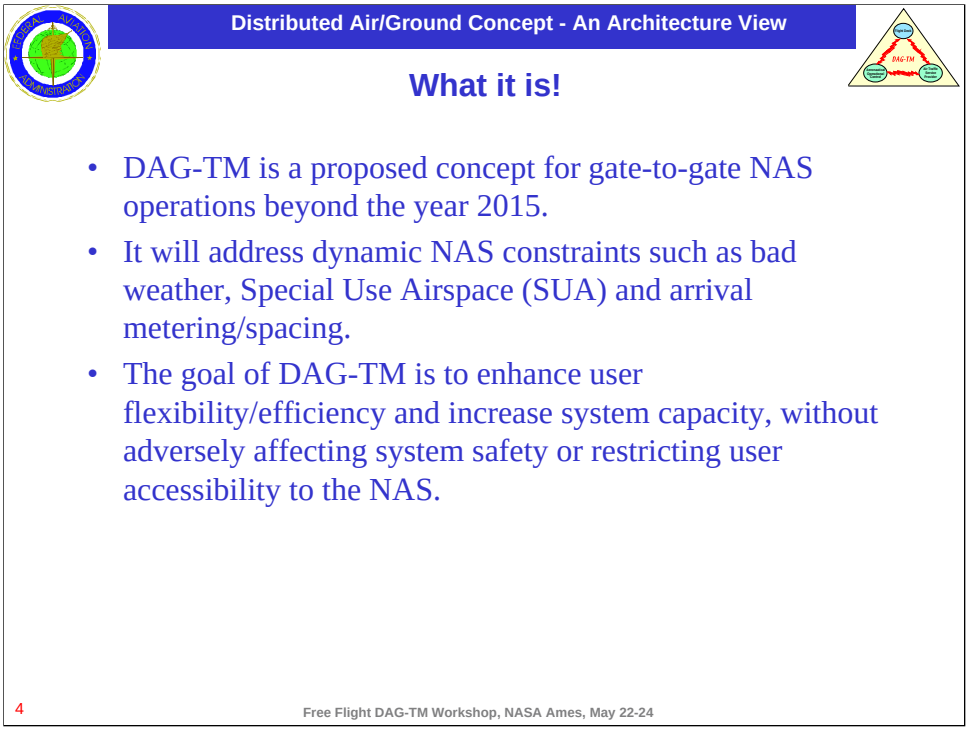
Questions for DAG. How will the flight deck's objectives be matched to these multi-center flow objectives? What is the operational/flight objective we seek to achieve?



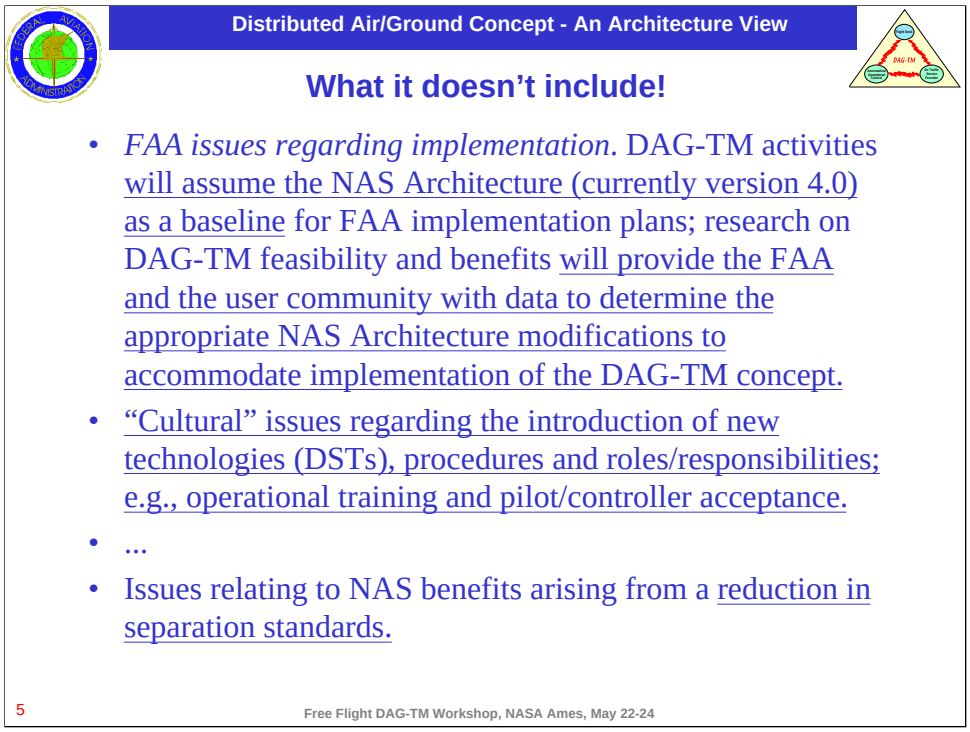

With that in mind we look to the DAG vision.

The vision of DAG makes this integration of objectives a goal, underline 1, and notes that it will have impacts across all infrastructure services that the NAS provides.

Note: Still unclear what the measure of goodness is - fuel, time enroute, etc.




The concept states are the factors to be included in DAG.

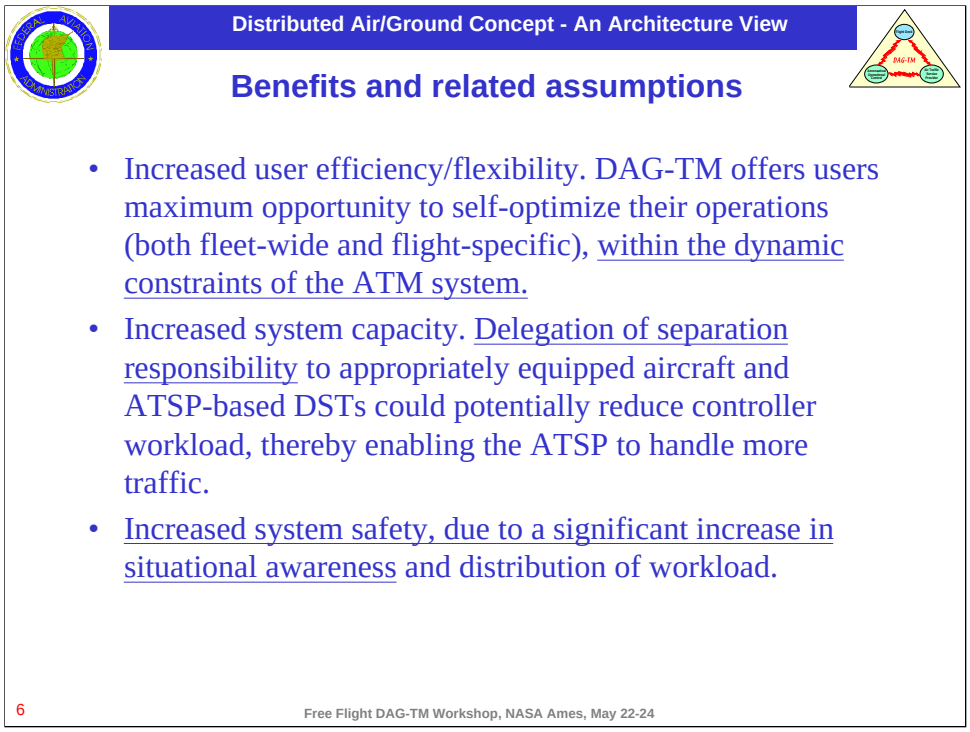



The list of things that aren't included is not trivial.

First, DAG is not looking to the full impact on the NAS with respect to its requirements on the NAS. That is left to the FAA. One argument for this is that DAG is only going to technical readiness level 4.

Second, DAG will assume that the cultural issues related to changing roles and responsibilities will be handled by the FAA.

It won't consider any changes in separation although the introduction of any improved flight deck will result in calls for such changes.

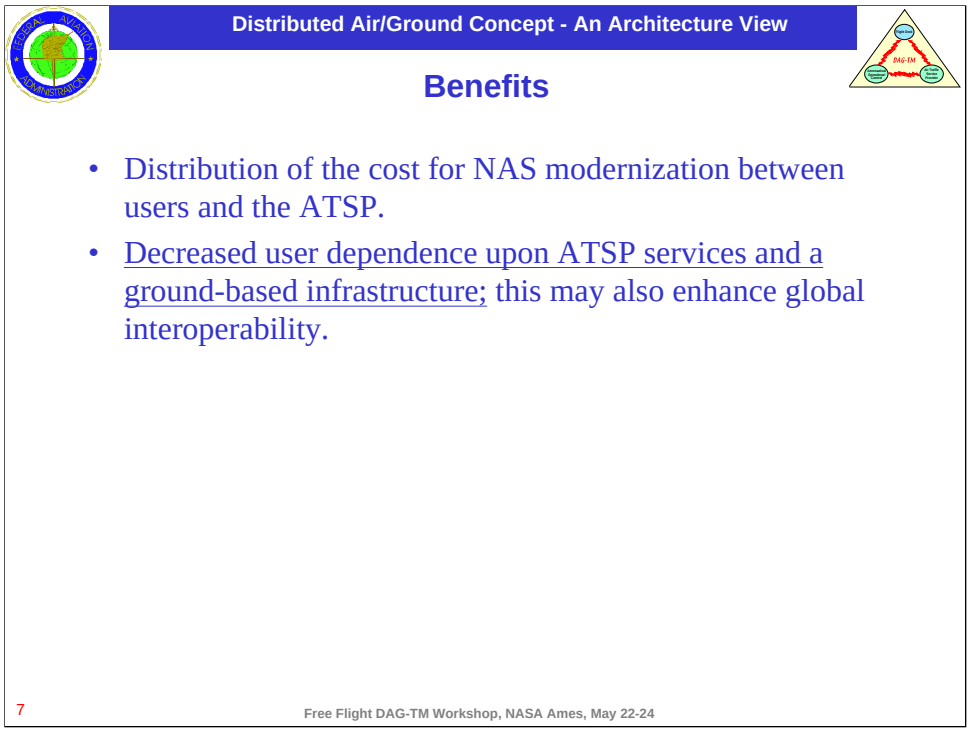



Quotes from the DAG concept to consider.

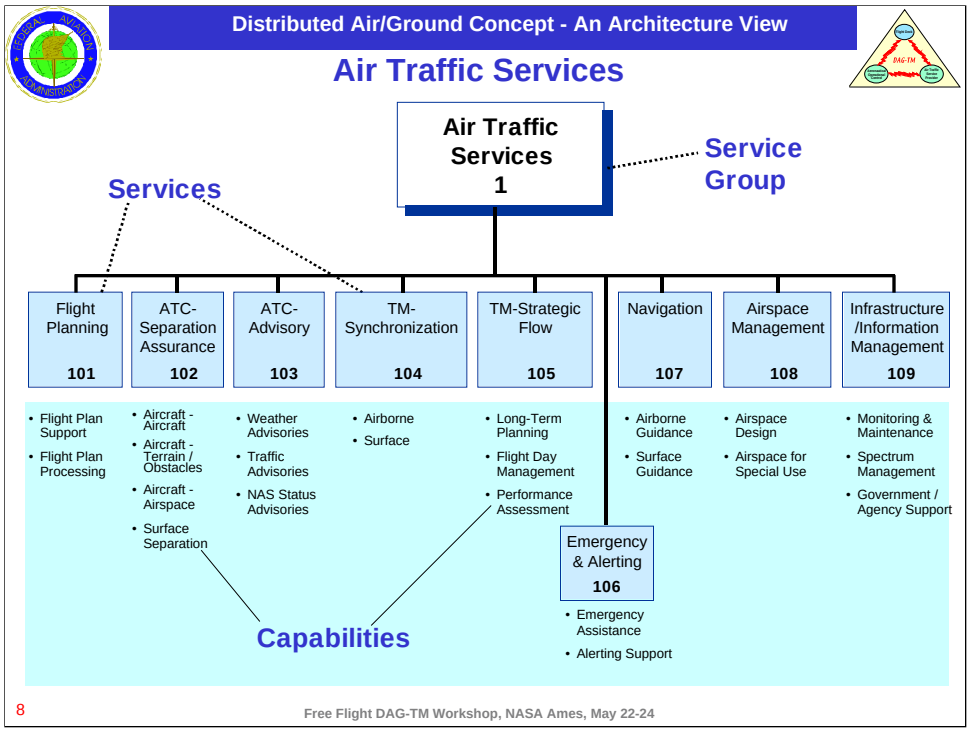
Bullet 1: Dynamic constraints is a information requirement on the current NAS for which the constraints are either static and published, or verbally exchange in written down by pencil on paper.

Bullet 2: This may not match the list of not included.

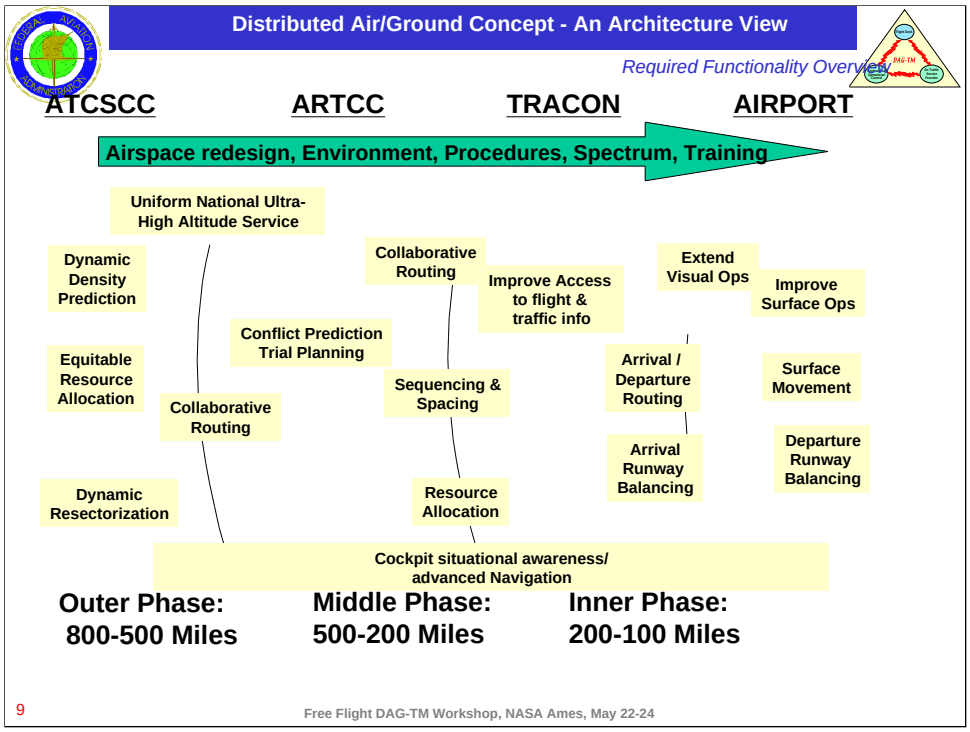
Bullet 3: By what measure is the safety in the NAS compromised by lack of situational awareness? This may be true, but it requires statement of mechanism and measurement.



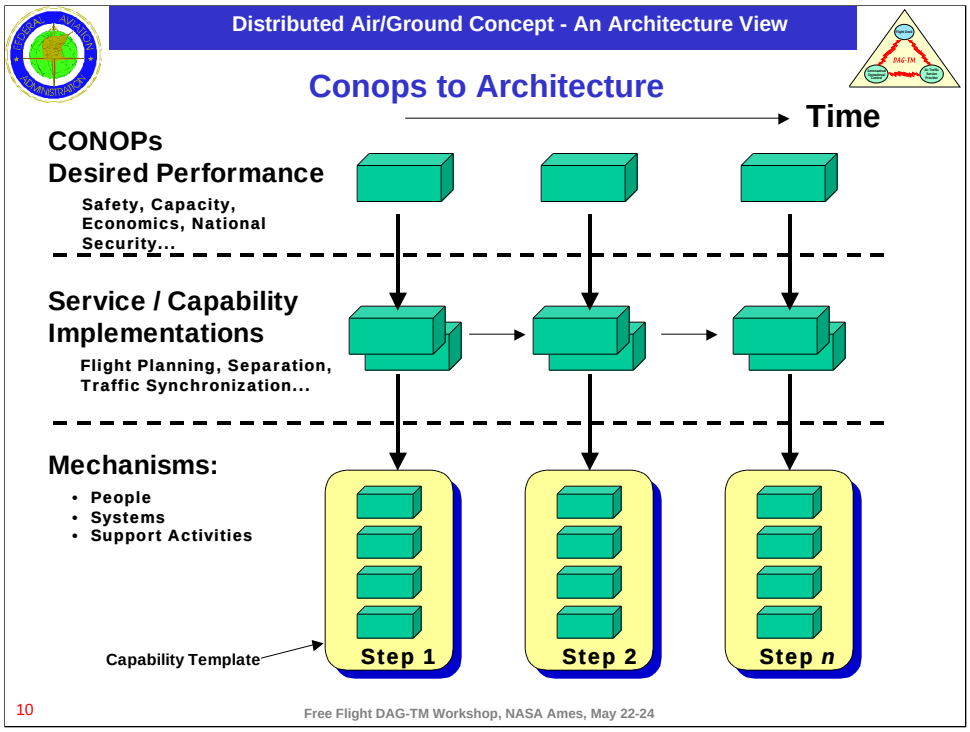

And more quotes form the DAG concept to consider. Implies that the FAA and its systems take a lesser role in the NAS. Lesser or different?




Let’s set the framework for the architecture. These are the NAS services and sub-elements. These services and capabilities derive from statute and treaty. These are the services that the FAA is required to ensure. These services can be provided directly by ATC or by standards, procedures and equipage.

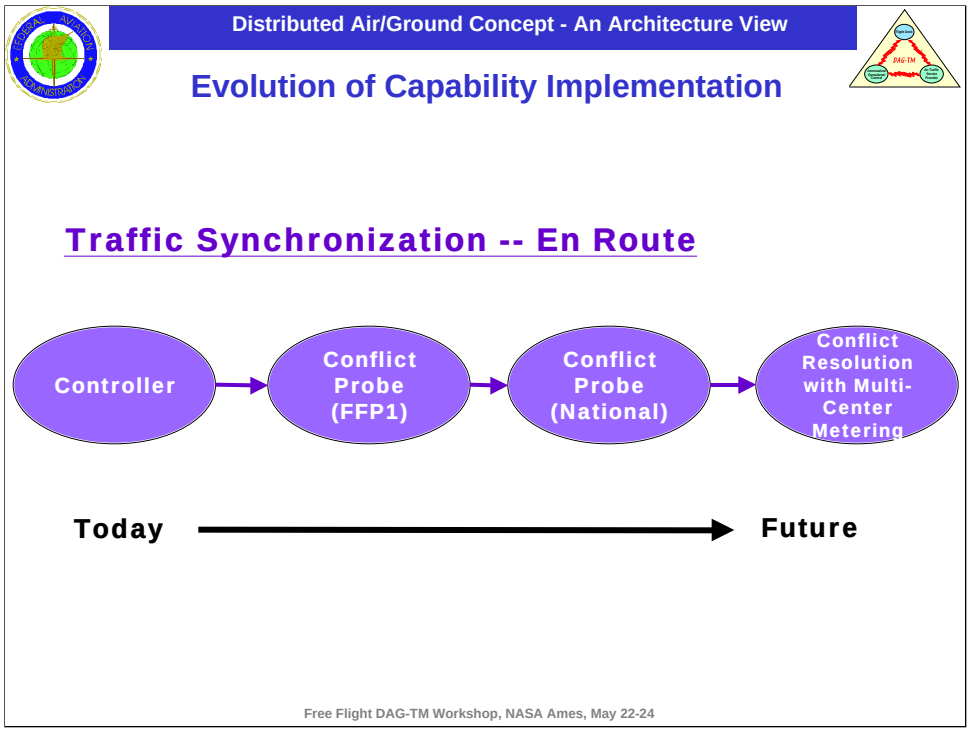



Within each service there is a expectation of performance and level of service. This slide from Roger Wall's of the Free Flight Select Committee shows the expectation that the user community has for airsapce, flow, separation, and advisory services.



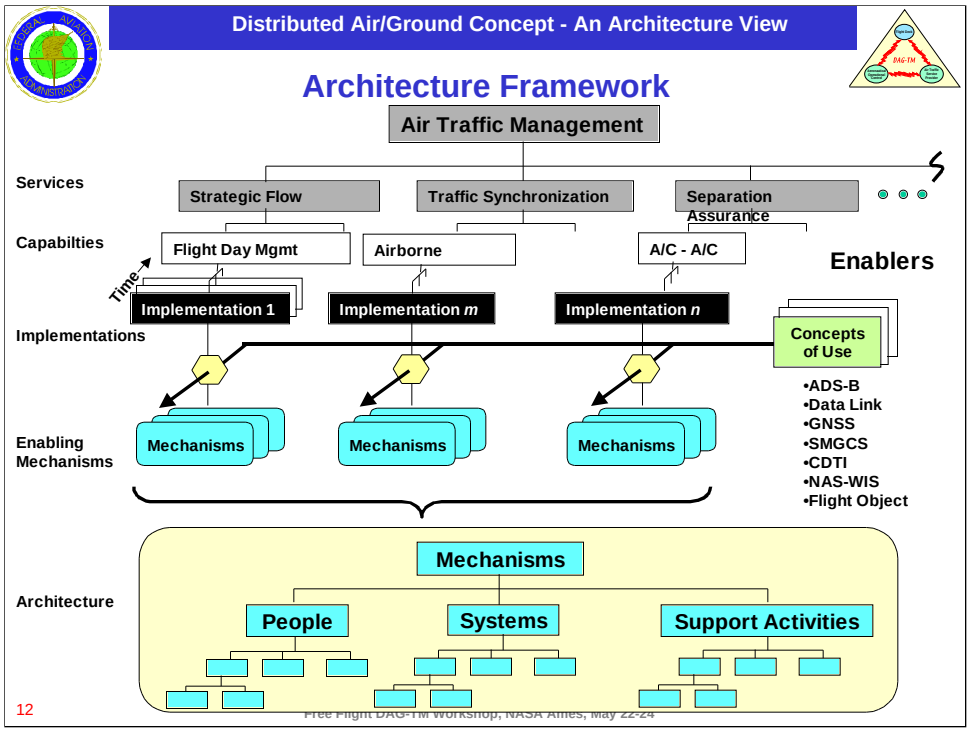

This is a example of what is fundamental in the NAS and its architecture. These capabilities don't change. What does change is the desired performance for the service and the manner in which the capability/service is provided. The concept of operations provides the articulation of how the service is to evolve, this are then captured as changes in implementations. DAG is not a new service, it is a set of implementations that replace existing methods for delivering service.

How do we fit DAG in ? Let's go ack to the evolution of the bubbles. This evolution is also capture in a transition in the mechanisms/packages of that support the implementation and the improved performance.

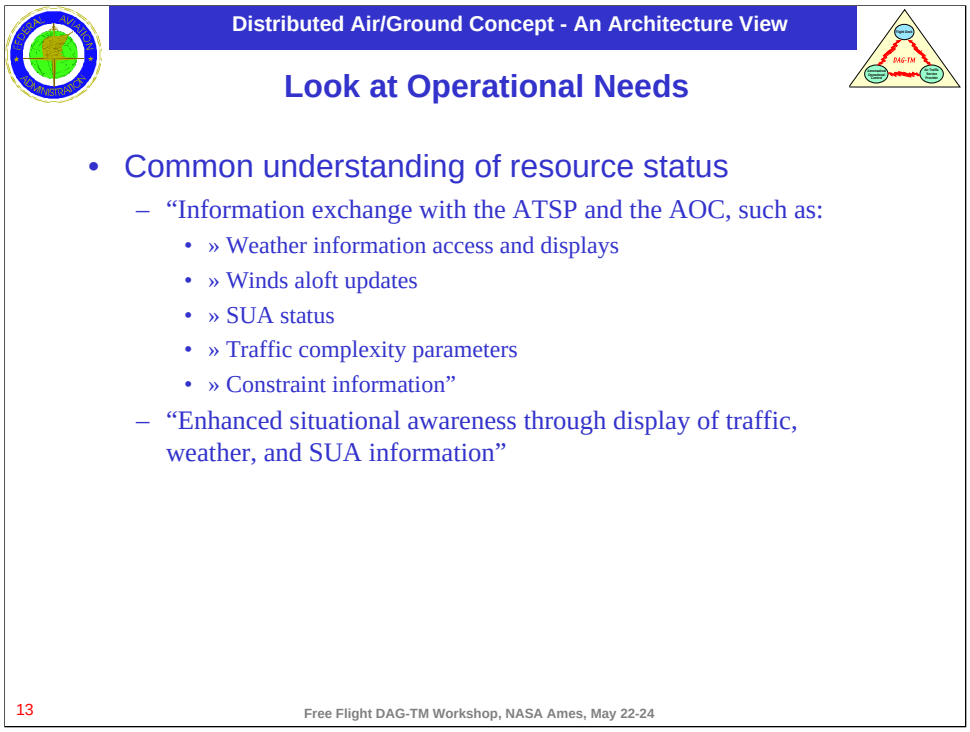



Let's look at one evolution for which DAG may be the future state. The point to take form here and the story we will develop throughout this mornings briefings is that the underlying activities laid out in the architecture are not unique or new. In this case, the capability denoted as probing for conflict is not brand new. Controller's have been and continue to perform this activity. What is new is the individual implementations which make this activity more efficient and robust to meet the changing needs - traffic growth and user preferred profiles.

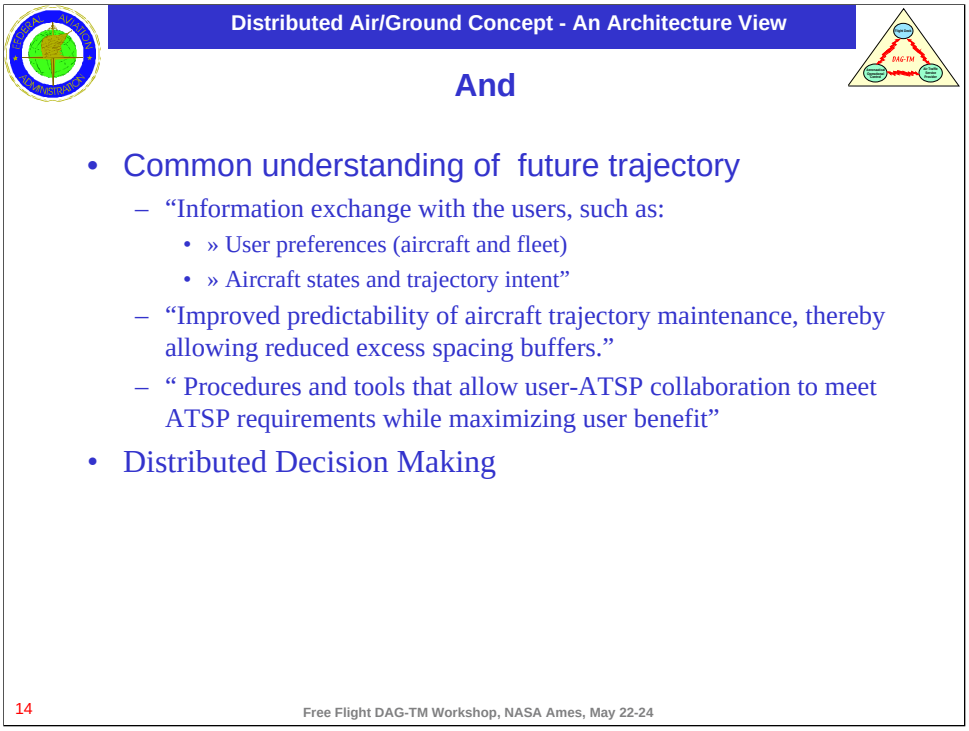
But how are the bubbles the basis of the architecture?



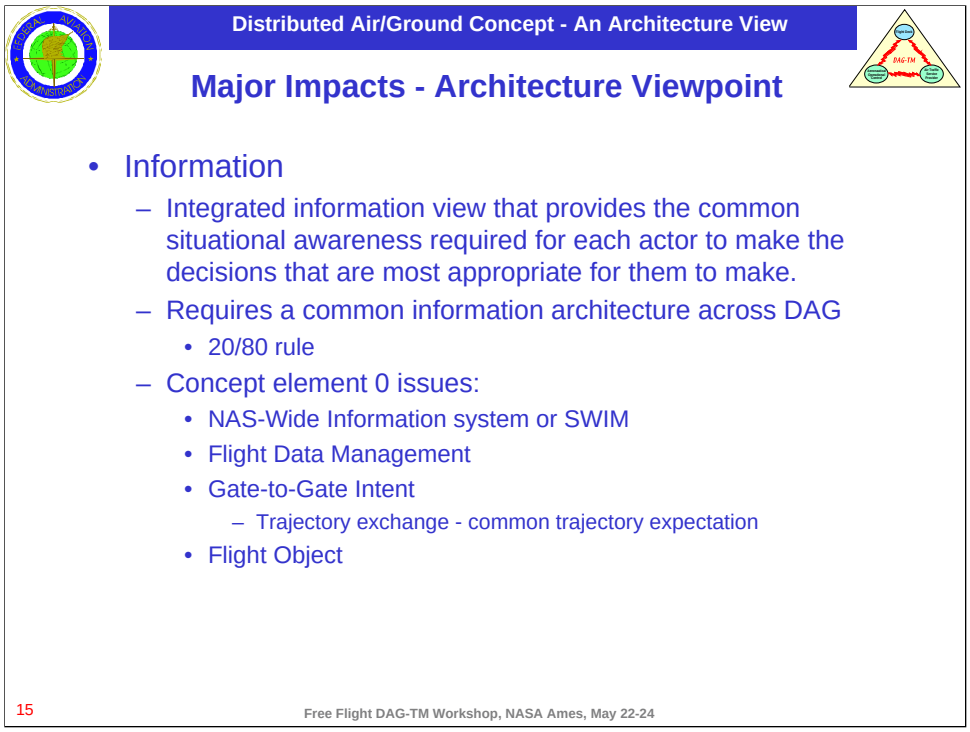

We look at all the operational performance requirements and establish operational needs. Each operational change has an expectation of improvement. To make that improvements possible, information must be manufacture, gathered exchange. The concepts of use are descriptions of how individual technologies work together to provide that information performance.




So what are the operational needs that will drive the concepts of use. Let's go again to the DAG concept. Here we see not only dynamic information, but also more information.




Here we see dynamic sharing of trajectories across flight deck and DSTs.

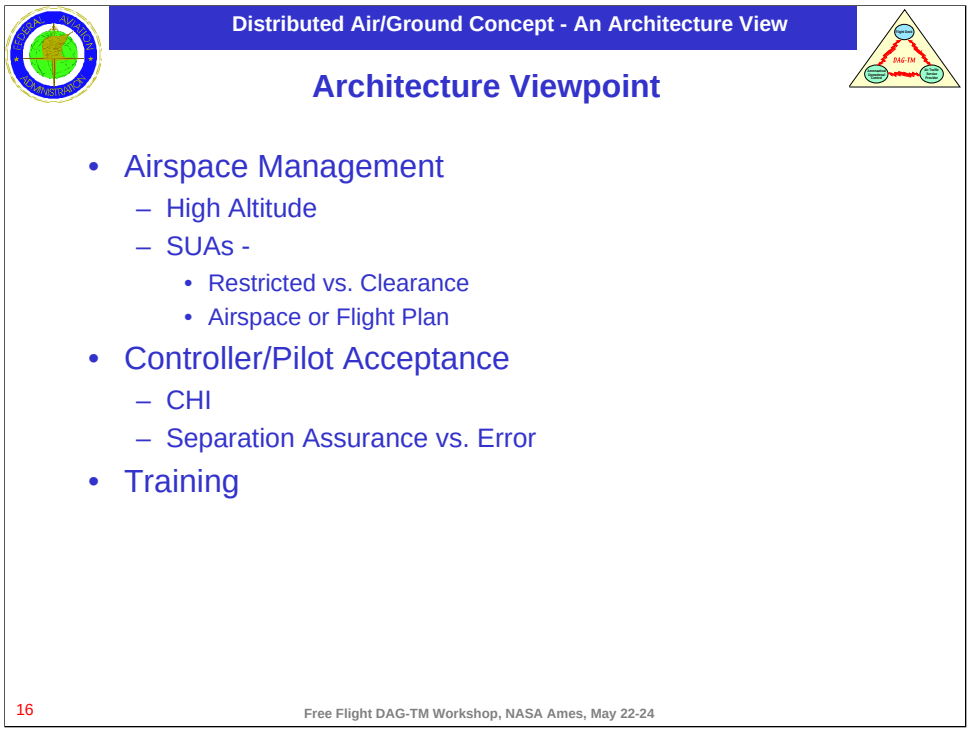



From these needs we begin to see impacts on the architecture and items which must be included.

The information exchange and common situational requirements will require an integrated approach and not an ad hoc application by application approach.

The 20/80 rule says that when 20% of the system is has been developed, 80% of the system design is set. Given our experience with other tools we see that this is true. If an integrated approach is not taken, we will be jury-rigging interfaces.

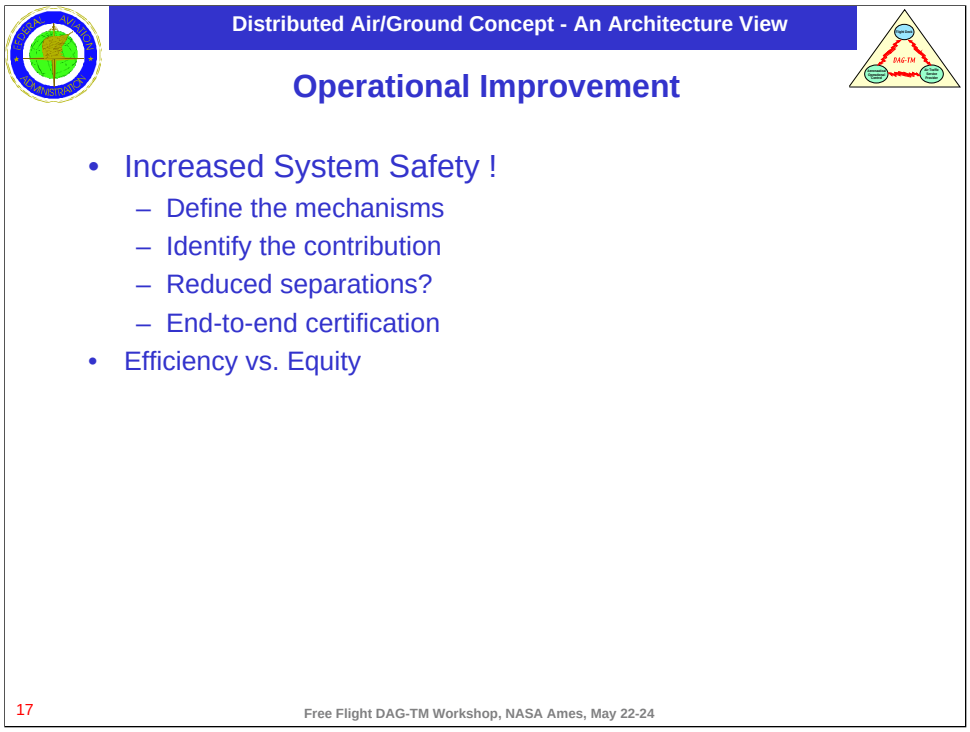
We also see that all systems that carry or compute a trajectory share that across the NAS so all individuals and systems have common situational awareness.



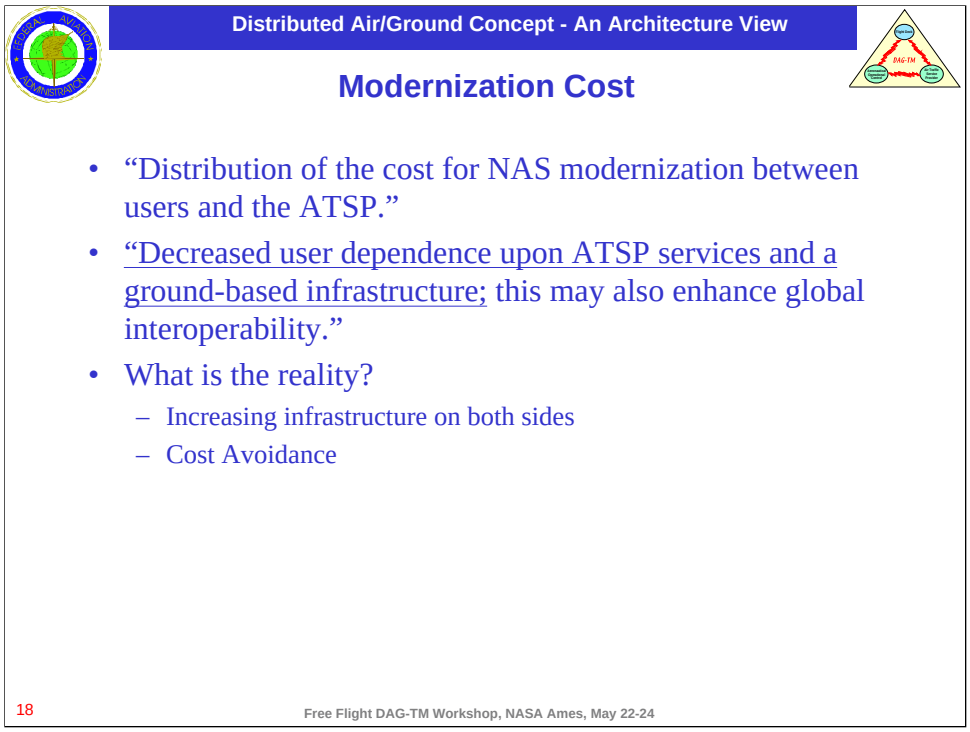

DAG has major impacts on many other aspects of the NAS. DAG and DAG requirements can have a major influence on the definition of the High Altitude Airspace. It can also provide justification for pursuing an airspace which encourages the more active role of the flight deck.

It also has major impact on the roles and responsibilities in the NAS. Including conflict detection, resolution, and flow conformance.

These are not trivial changes and will require extensive revisions to training.




There is also the promise of increased safety. DAG claims benefits for safety. On the face of this this might be true, but by what mechanism. One of the least well understood things is the manner in which safety is affected and improved in the NAS. IF DAG wants to claim benefits then define it and measure it. Such an activity can only increase the likelihood of defining the requirements for separation standards and how they may be affected by increased information




Finally, DAG defines an environment in which more- not less - information and strategies are shared across the NAS. There is no way that the dependence will decrease. Changing authority is different from dependency.

## Summary

- DAG has impacts on virtually every service and potential future implementations
- Need the transitions and timeframes
- Can't consider DAG as an experiment into step-wise improvements.